

Application Serial No: 09/814,487
In reply to Office Action of 16 September 2004

Attorney Docket No. 80095

REMARKS / ARGUMENTS

Claims 1-15 are currently pending in the application. Claims 1-15 are rejected. Claims 1-7, 9, 10, 14, and 15 have been amended. Claims 8, and 11-13 have been canceled. New claim 16 has been added.

The Examiner has objected to claims 1-15 because of the following informalities:

The Examiner states that in claim 1 there is lack of antecedent basis in the claim for the core having an "interior", as stated in lines 7-8; there is lack of antecedent basis in the claim for the fibers scattering light, as stated in line 18 ("affect" should be changed to --scatter-- in line 16); and there is lack of antecedent basis in the specification for the invention having a plurality of layers of optical fibers (lines 11-12). The Examiner further states in lines 15-17, it is not clear how there is temperature profile "data" in the fluid ("temperature profile data in" should be replaced with -- a temperature profile of --). The Examiner also states it is not clear how a cable comprises a receiver means, a light source, and a processing means, i.e., the preamble of claim 1 claims a "cable", but the body of the claim appears to claim an assembly or system using a cable.

The Examiner states that the subject matter claimed in lines 4-6, 7-9, and 11-14 is not clearly stated, e.g., it is not

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clear how 1) the jacket defines an annular space between the jacket and core (lines 4-6) since the specification and figures disclose that there is no space between the core (14) and the jacket (18); 2) how the armor wires are located in the annular space (lines 7-8), since there is no annular space between the core and jacket; 3) the optical fibers are "around the core" (line 11) and interspersed "in said core" (line 13) since the annular space is outside the core between the core and the jacket; and 4) how the optical fibers are located in the annular space (lines 11-12), since there is no annular space between the core and jacket.

The Examiner further states there is no structural relationship between the processing means and the receiver (e.g., the processing means analyzes the scattered light received by the receiver to provide a measurement of the temperature profile of the fluid).

The Examiner states in claim 2, there is lack of antecedent basis in the claim for "said processor"; and "data" should be deleted.

The Examiner states in claim 5, it is not clear how the wires are made of steel and KEVLAR™. The specification discloses that either the fiber is surrounded by an armor wire or steel tube, OR is surrounded by a bundle of steel armor wires encased by a KEVLAR™ sleeve (see page 5, lines 9-13, and 15)

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The Examiner states in claim 6, there is lack of antecedent basis in the disclosure for an optical fiber being enclosed in a steel tube and being located in an armor wire (see claim 1). The disclosure stated that either the fiber is surrounded by an armor wire or steel tube, OR is surrounded by a bundle of steel armor wires encased by a KEVLAR™ sleeve.

The Examiner states in claim 7, there is lack of antecedent basis in the disclosure for an optical fiber being surrounded by a plurality (bundle) of steel armor wires AND being located in an armor wire (see claim 1). The disclosure stated that either the fiber is surrounded by an armor wire (18) or steel tube, OR is surrounded by a bundle of steel armor wires (23) encased by a KEVLAR™ sleeve.

The Examiner states that in claim 10 there is lack of antecedent basis in the claim for "stainless steel".

The Examiner states that in claim 12 and 13 there is lack of antecedent basis in the claims for an "outer layer" of armor wires, and it is not clear how the armor wires are in the outer layer since they have been replaced (are no longer in the outer layer).

The Examiner states that in claim 14, there is no structural relationship between the processing means (of claim 1) and the processing system (is the processing system the

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processing means, or is it used in addition to the processing means?)

The Examiner states that claims 1-15 have numerous typographical errors, and requests appropriate corrections be made.

The Examiner rejects claims 1-15 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

The Examiner states in claim 1, the subject matter claimed in lines 4-6, 7-9, and 11-14 is not clear, e.g., it is not clear how 1) the jacket defines and annular space between the jacket and core (lines 4-6) since the specification and figures disclose that there is not space between the core (14) and the jacket (18); 2) how the armor wires are located in the annular space (lines 7-8), since there is no annular space between the core and jacket; 3) the optical fibers are "around the core" (line 11) and interspersed "in said core" (line 13) since the annular space is outside the core between the core and the jacket; and 4) how the optical fibers are located in the annular space (lines 11-12), since there is not annular space between the core and jacket.

The Examiner rejects claims 2-15 for being dependent on rejected base claim 1.

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The Examiner rejects claims 1-15 under 35 U.S.C. 103(a) as being unpatentable over Yamaguchi et al (Reference A: U.S. Patent No. 5,198,662) in view of Holmberg (Reference. B: U.S. Patent No. 5,212,755).

The Examiner argues that Yamaguchi disclosed a system for measuring a temperature profile of a body of water using an optical fiber tow cable suspended into the body of water from a ship, and a measuring device for continuously measuring temperature at various points along the length of the cable. The cable (4) comprises a core (15) having optic fibers (14) therein and surrounded by steel armor wires (16). The measuring device used OTDR (see figures 5 and 6) and comprises a light source that transmits optical pulses of light into the fibers, a receiver that receives backscattered light (Raman scattering) from the fibers, processing means for analyzing the backscattering light to measure the temperatures of the water along the length of the cable and measure the temperature profile, and a display unit for generating a visual representation (figure 6) of the temperature profile data (see figures 1, 3, and 6; column 3, lines 34-68; and column 4, lines 1-12).

The Examiner also argues that Yamaguchi does not disclose that the fiber optic tow cable comprises a core; a jacket concentric with the core and defining an annular space between

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the jacket and the core; a plurality of steel or KEVLARTM armor wires radially spaced outside the interior of the core in the space defining a radially located layer circumferentially concentric and spaced from the interior of the core; a plurality of optic fibers around the core in the outermost layer in the space interspersed in the core in a plurality of armored wires in the radially located layer; the plurality of fibers being enclosed in a steel tube or surrounded by a plurality of steel armor wires having a smaller diameter than the armor wires; and a corresponding armor wire is replaced by a fiber in the steel armor wire having a smaller diameter than the armor wires.

The Examiner argues that Holmberg discloses a fiber optic tow cable comprising:

A core (22);

A jacket (32) concentric with the core and defining an annular space between the jacket and the core;

A plurality of armor wires (26) radially spaced outside the interior of the core in the space and defining a radially located layer circumferentially concentric and spaced from the interior of the core, wherein the wires can be steel (16) or KEVLARTM fibers (26); and

A plurality of optic fibers around the core in the outermost layer in the space interspersed in the core in a plurality of armored wires (28) in the radially located layer.

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The cable is an improvement over prior art cables that have the fiber in the core since the optic fiber is placed outside of the core which reduces strain on the fiber, thereby improving the optical characteristics of the fiber (see figure 2; column 1, lines 15-63; column 2, line 52-column 3, line 17). The fibers can be enclosed in steel tubes or be surrounded by a plurality of steel armor wires having a smaller diameter than the armor wires, and a corresponding armor wire is replaced by a fiber in the steel armor wire having a smaller diameter than the armor wires (see column 2, lines 14-42).

The Examiner states that referring to claim 1, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the cable of Yamaguchi by replacing the tow cable with a tow cable as taught by Holmberg, in order to provide a cable having reduced strain on the fibers thereby obtaining improved temperature measurements. The Examiner further states the fibers are placed in the "outer layer" since there is only one layer of armor wires.

These rejections are respectfully traversed.

Yamaguchi appears to teach a measuring system measures temperature distribution in water using an optical fiber. An optical fiber cable suspended from a ship and towed by the ship to form an arch within the water. A measuring device for continuously measuring temperature at various points along the

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lengths of said optical fiber cable. Sensors are provided within the water to calculate the water depth at each of the various points along the length of the arch shaped optical fiber. Thus, a temperature distribution at each water depth can be continuously measured.

Holmberg teaches an armored fiber optic cable is disclosed having both fiber optics and armor wires located outside the cable core in position where the fiber optics experience low strain when the cable is under stress. In one embodiment, metal armor wires and optical fibers embedded in metal tubes are arrayed in one or more layers about the outside the cable core. In another embodiment, KEVLAR armor wires and optical fibers embedded within a hard composite shell are arrayed in one or more layers about the outside the cable core, and a layer of KEVLAR armor is provided surrounding the one or more layers. In each of the embodiments the strains that the fiber optics experience due to core stresses and due to core residual strain is materially reduced over the heretofore known armored fiber optic cables.

Applicants teach an integrated fiber-optic tow cable is described having both optical fibers and armor wires located outside the cable core to avoid high strain on the optical fibers when the cables is under stress during deployment. The optical fibers have integral temperature sensors near the outermost

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portion in order to measure accurately the temperature of the fluid coming in contact with temperature sensors. A beam of light is shown on the optical fibers and is reflected by the optical fibers and reaches the receiver and processed by the processor that may also include a display unit.

Concerning paragraph 1 of the Examiner's Office Action, stating the Examiner's objections to Applicants' claims 1-15 because of informalities, Applicants have made the following amendments to correct the informalities:

Applicants have amended the first element of claim 1 such that it teaches a "core having an interior and an exterior" providing an antecedent basis for the term "interior."

Applicants have amended the fifth element of claim 1 as suggested by the Examiner such that "affect" is now changed to "scatter."

Applicants have amended the third element of claim 1 striking the phrase "in a plurality of layers in the annular space" thereby correcting informality of a lack of antecedent basis in the specification for "a plurality of layers of optical fibers."

Applicants have amended lines 15-17 of claim 1 as suggested by the Examiner such that the phrase "temperature profile data in" is replaced with "a temperature profile of."

Applicants have amended the preamble of claim 1 by including the word "system" such that it now claims "An instrumented fiber

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optic tow cable system," in order to correspond with the body of the claim.

Applicants have amended claim 1 such that there is no reference to any annular space between the core (14) and the jacket (18).

Applicants have amended claim 1 such that it no longer claims that the optical fibers are "around the core" and interspersed "in said core."

Applicants have amended the last element of claim 1 such that it now claims a structural relationship between the processing means and the receiver means.

Applicants have amended claim 2 such that the term "processor" which had no antecedent basis was stricken and replaced by the term "processing means."

Applicants have amended claim 2 such that the term "data" was stricken.

Applicants have amended claim 5 such that it now depends from claim 1 rather than claim 4 so that it is no longer claiming a plurality of armor wires made of both steel and KEVLAR™.

Applicants have amended claim 1 and claim 6 such that claim 6 no longer claims an optical fiber being enclosed in a steel tube AND being located in an armor wire.

Applicants have amended claim 1 and claim 7 such that claim 7 no longer claims an optical fiber being surrounded by a plurality

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(bundle) of steel armor wires AND being located in an armor wire.

Applicants have amended claim 10 to correct the lack of antecedent basis in the claim for "stainless steel" by striking the term "stainless" from the claim.

Applicants have canceled claims 12 and 13 in response to the Examiner's objections.

Applicants have amended claim 14 by striking the term "system" and replacing it with the term means.

Applicants have attempted to correct all typographical errors in claims 1-15.

Concerning paragraph 3 of the Examiner's Office Action, stating the Examiner's rejection in of Applicants' claims 1-15 under 35 U.S.C. 112 second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention, Applicants have amended claim 1 such that there is no reference to any annular space between the core (14) and the jacket (18).

Applicants have amended claim 1 such that it no longer claims that the optical fibers are "around the core" and interspersed "in said core."

Concerning paragraph 5 of the Examiner's Office Action stating the Examiner's rejections of Applicants' claims 1-15 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,198,662 to Yamaguchi et in view of U.S. Patent 5,212,755 to Holmberg, the

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Examiner claims that Holmberg discloses a plurality of optic fibers around the core in the outermost layer in the space interspersed in the core in a plurality of armored wires (28) in the radially located layer. Applicants respectfully argue Holmberg does not specifically teach or suggest placing the optic fibers in the outermost layer of armor fibers. In fact, in FIG 1 the optic fibers (18) are interspersed among the armor wires of the inner layer of armor wires. Holmberg teaches that the fiber optics embedded in metal tubes should be interspersed among the armor wires "preferably in the innermost layers thereof to protect the fiber optic cables." (Col. 2 lines 21-23). Holmberg also teaches that "... it is desirable for the fiber-bearing tubes 18 to be in the inner layer, where the tubes are protected when the cable is passed over sheaves." (Col. 2 lines 46-49).

The Examiner claims that Holmberg teaches optical fibers can be surrounded by a plurality of steel armor wires having a smaller diameter than the armor wires in Col. 2 lines 14-42. The Applicants respectfully argue that this is not taught in any part of the Holmberg disclosure. Holmberg teaches having the fiber optics embedded in metal tubes generally designated 18. (Col. 2 lines 19-20). Holmberg goes on to teach "The optical fibers are preferably embedded in stainless steel tubes,..." (Col. 2 line 30). Holmberg also teaches an embodiment with the "optical fibers embedded within a KEVLAR reinforced matrix ..." (Col. 2 lines 66-

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67), which is essentially an optical fiber embedded in an armor wire made of KEVLAR or another synthetic material. (Col. 3 lines 8-28). Holmberg never mentions a plurality of steel armor wires having a smaller diameter than the armor wires.

Applicants state that there must be some suggestion or motivation to modify Holmberg or Yamaguchi to combine these reference teachings. Applicants respectfully argue that the Examiner has not demonstrated any suggestion or motivation to combine the references.

Furthermore, Applicants respectfully argue that the prior art references Holmberg and Yamaguchi when combined do not teach or suggest all of the claim limitations of Applicants' application, such as surrounding the optical fiber with armor wires either 23 or 48 of a smaller diameter than the surrounding armor wires 18 and 44, or such as interspersing the optical fibers in the outer layer of armor wires. The Holmberg patent did not consider placing the optic fiber bearing tubes in the outer layer of armor wires. Applicants state that double armored steel tow cables are subject to large potentially crushing forces during deployment and retrieval. At the time of the Holmberg patent, it was thought by those skilled in the art that the tubes would not survive in the outer layer. This is way Holmberg specifies placing the tubes in the inner layer to avoid crushing them. Placing the optical fibers in the outer layer of armor wires is a novel feature of the

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present invention not taught by the prior art.

The Examiner's claim that the fibers are placed in the "outer layer" since there is only one layer of armor wires in the Yamaguchi patent is incorrect. Figure 3 of the Yamaguchi patent clearly shows a metal pipe 13 in which one or two optical fibers 14 are sealed in a filler material with steel wires 16 twisted around the exterior of the pipe such that the pipe is inside the layer of wires, and thus forms a second or inner layer (in agreement with Holmberg). The Yamaguchi states "The cable 4 includes a centrally located stainless steel pipe 13 in which one or two optical fibers 14 are sealed in a filler material (such as fluororesin) and steel wires 16 serving as tension members and twisted together around the pipe 13." (Col. 3 lines 34-39). Applicants respectfully argue that there is nothing contained in the Yamaguchi patent that teaches or suggests placing a tube containing an optical fiber in the outer layer of the steel wires 16.

Applicants respectfully suggest in view of these remarks that all grounds for rejection and objection have been removed by the foregoing amendments. Applicants state that no new matter has been added by this amendment. Reconsideration and allowance of this application are therefore earnestly solicited.

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The Examiner is invited to telephone Jean-Paul A. Nasser, Attorney for Applicants, at 401-832-4736 if, in the opinion of the Examiner, such a telephone call would serve to expedite the prosecution of the subject patent application.

Respectfully submitted,
ANTHONY A. RUFFA, ET AL

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